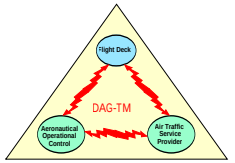
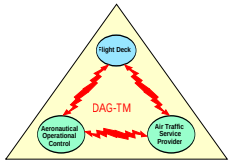


Terminal Arrival: Self-Spacing for Merging and In-Trail Separation

(Concept Element 11)

Richard Mogford, NASA Ames
Gary Lohr, NASA Langley

Self-spacing for Merging and In-trail Separation



Problem:

- Excessive spacing buffers on final approach reduce arrival throughput and airport capacity

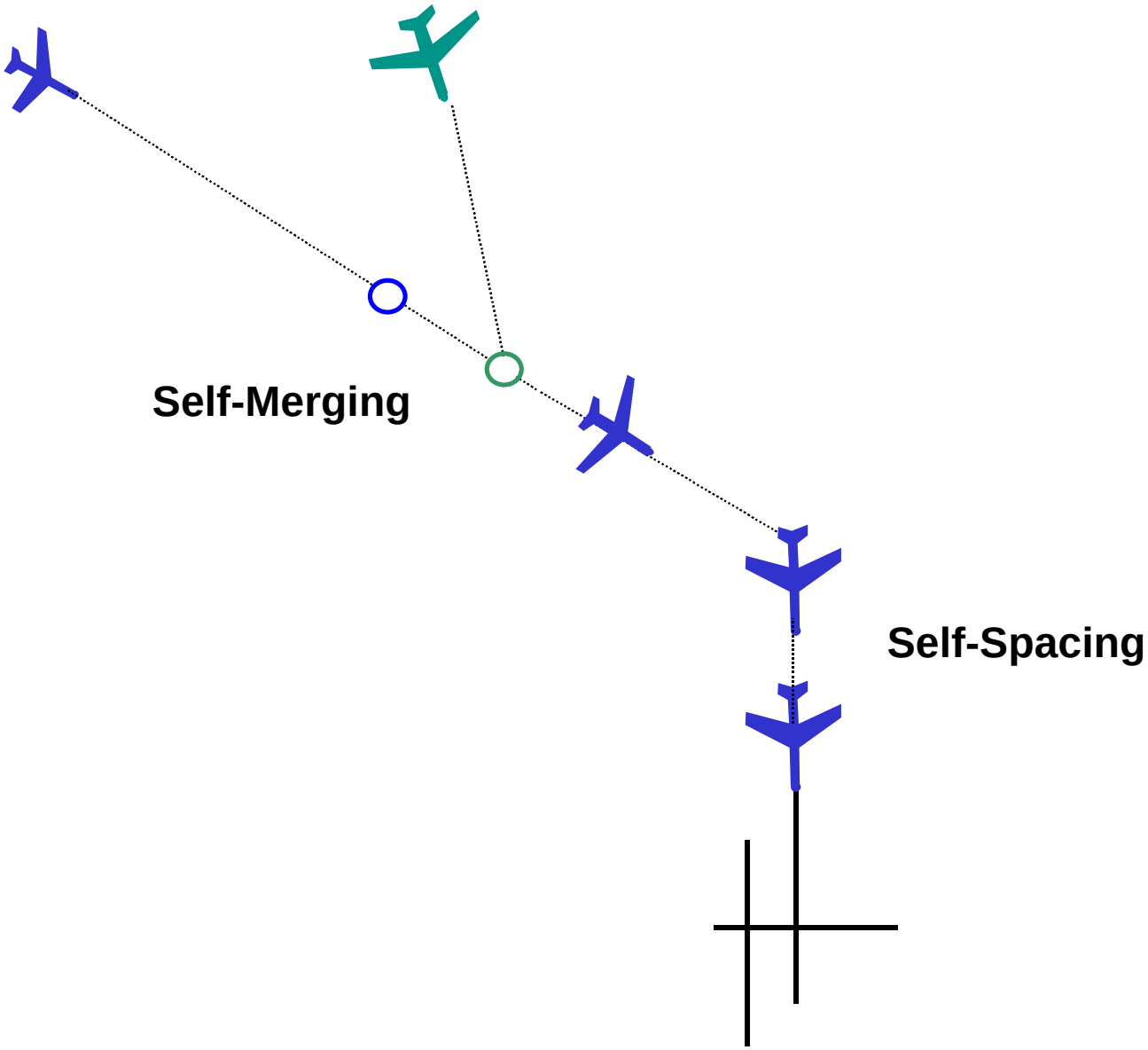
Solution:

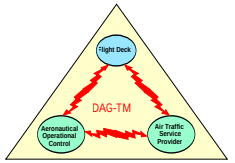
- Appropriately equipped aircraft are cleared to maintain separation relative to other aircraft during both instrument and visual conditions
  - flight deck displays and guidance for:
    - Merging and conflict detection/resolution
    - Fine tuning of fixed-time spacing

Benefits:

- Increased arrival throughput
- Enhanced controller & pilot shared understanding of traffic management plan

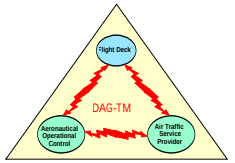
Self-spacing for Merging and In-trail Separation





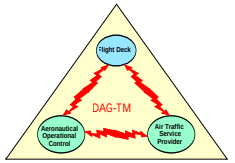
Research Plan

- **Goal: To evaluate feasibility of concept**
  - **Three phases planned**
- **Phase 1: Airborne management of post-merge in-trail temporal spacing**
  - **Controller uses DST to set up initial sequence, monitors operations, and controls non-equipped aircraft**
  - **Pilots given autonomy to tighten spacing using CDTI**
- **Phase 2: Airborne management of merging and spacing on structured arrival routes**
  - **Controller uses DST to set up initial sequence, monitors operations, and controls non-equipped aircraft**
  - **Flight crew manages merge into arrival stream using CDTI**
  - **Self-spacing on final**



Research Plan

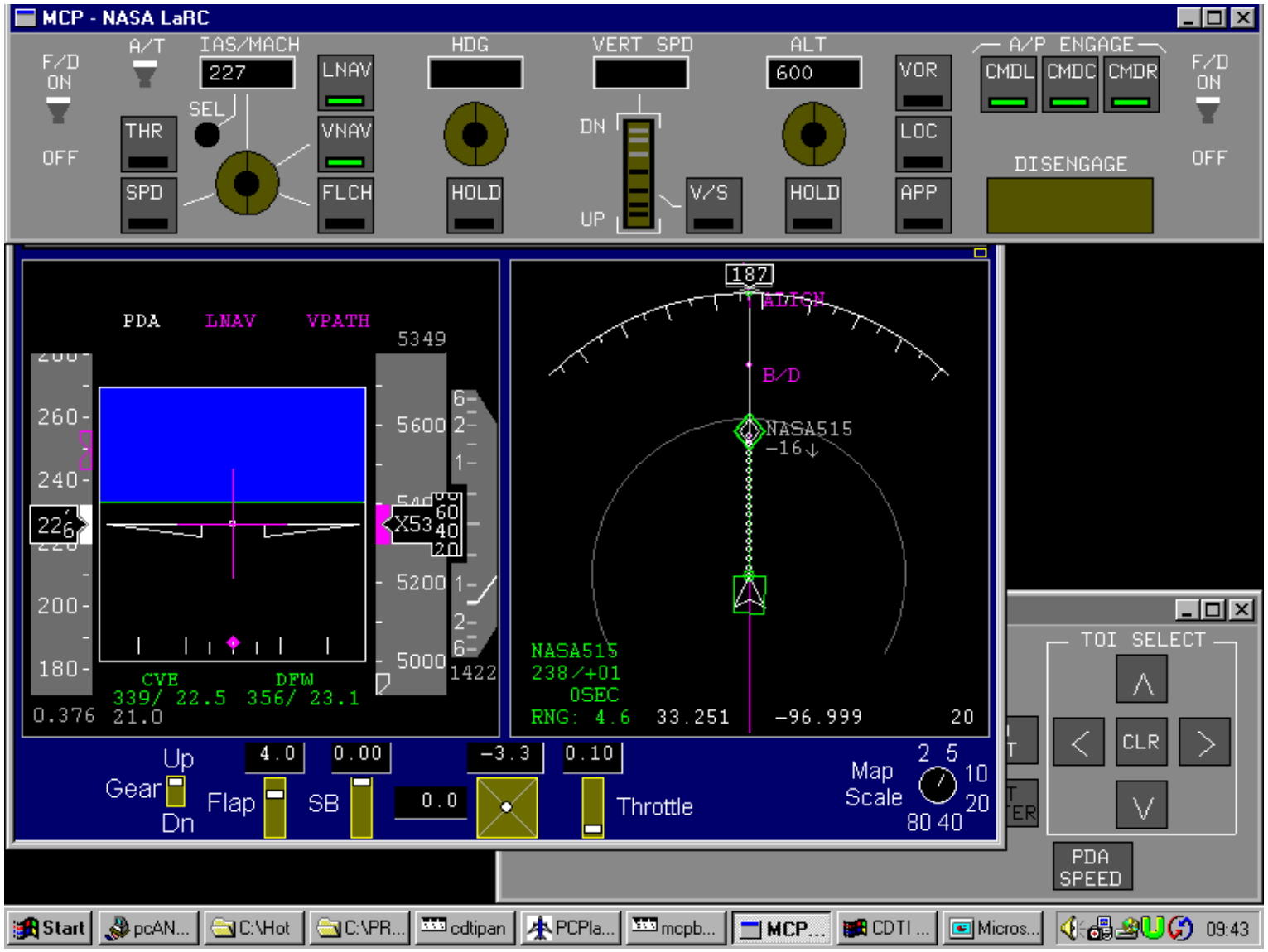
- **Phase 3: Airborne management of merging and separation o unstructured arrival corridors**
  - **Controller sets up initial sequencing and monitors airspace for conflicts**
  - **Structured arrival routes are replaced with arrival regions**
  - **Participating aircraft cross an arrival boundary and maneuver within designated arrival regions**
  - **Aircraft are responsible for separation assurance and remaining inside the arrival regions**
  - **Pilots use CDTI for merging into arrival streams based on sequence assignments provided by the controller**
  - **Non-participating aircraft remain on structured arrival routes and receive all clearances from the controller**



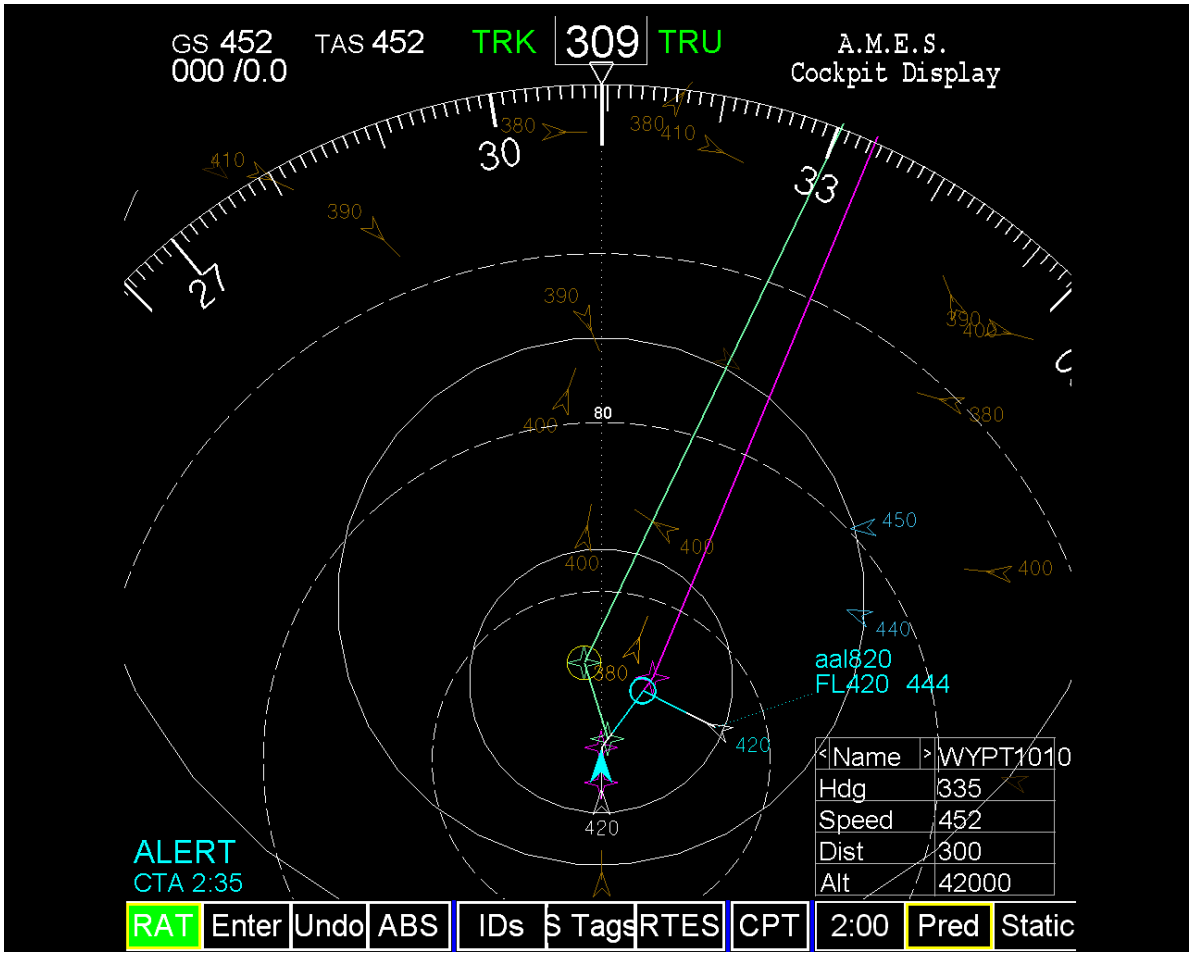
Research Issues

- How to realize benefits:
  - Pre-merge
  - Post-merge
  - Unstructured sector
- Design of CDTI for self-merging and spacing
  - Including CD&R logic
- Design of controller automation
  - Incorporation of planning tools into terminal workstation
- Roles of pilot and controller
  - Distributed decision making and responsibilities
  - Failure situations
  - Mixed equipage
  - Workload and other human factors issues

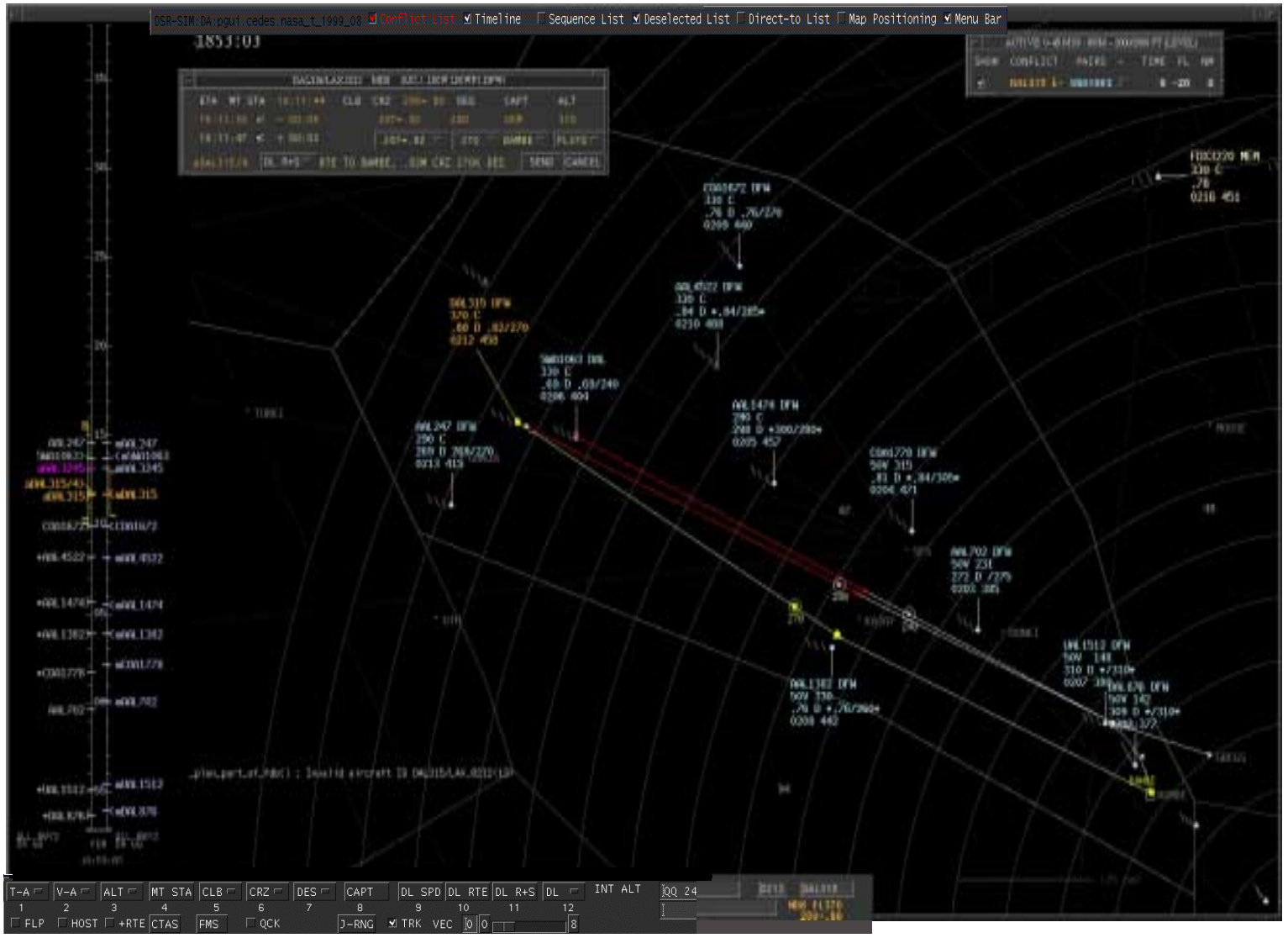
Automation Tools: Pilot (Spacing)



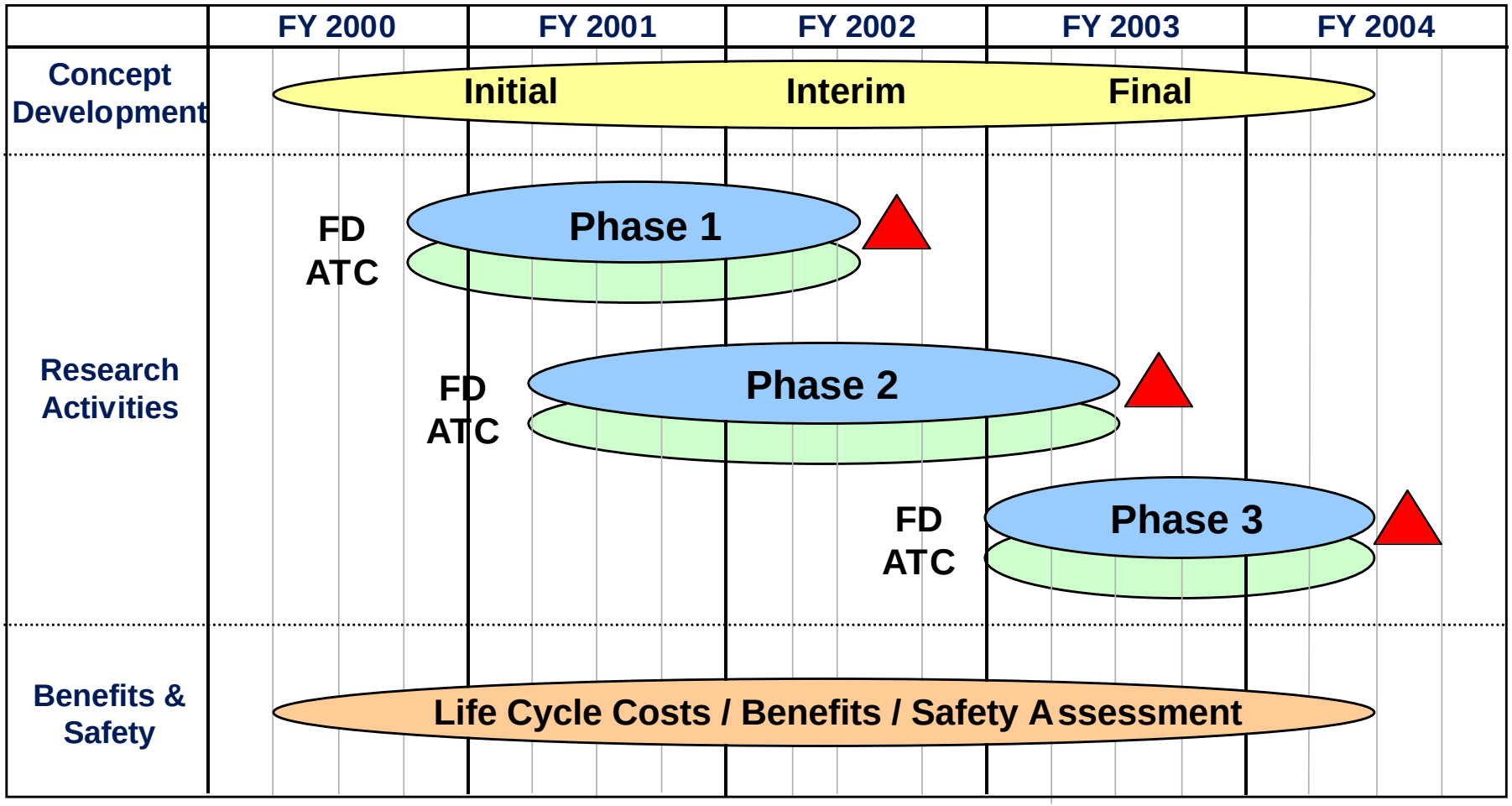
Automation Tools: Pilot (Self-Separation)



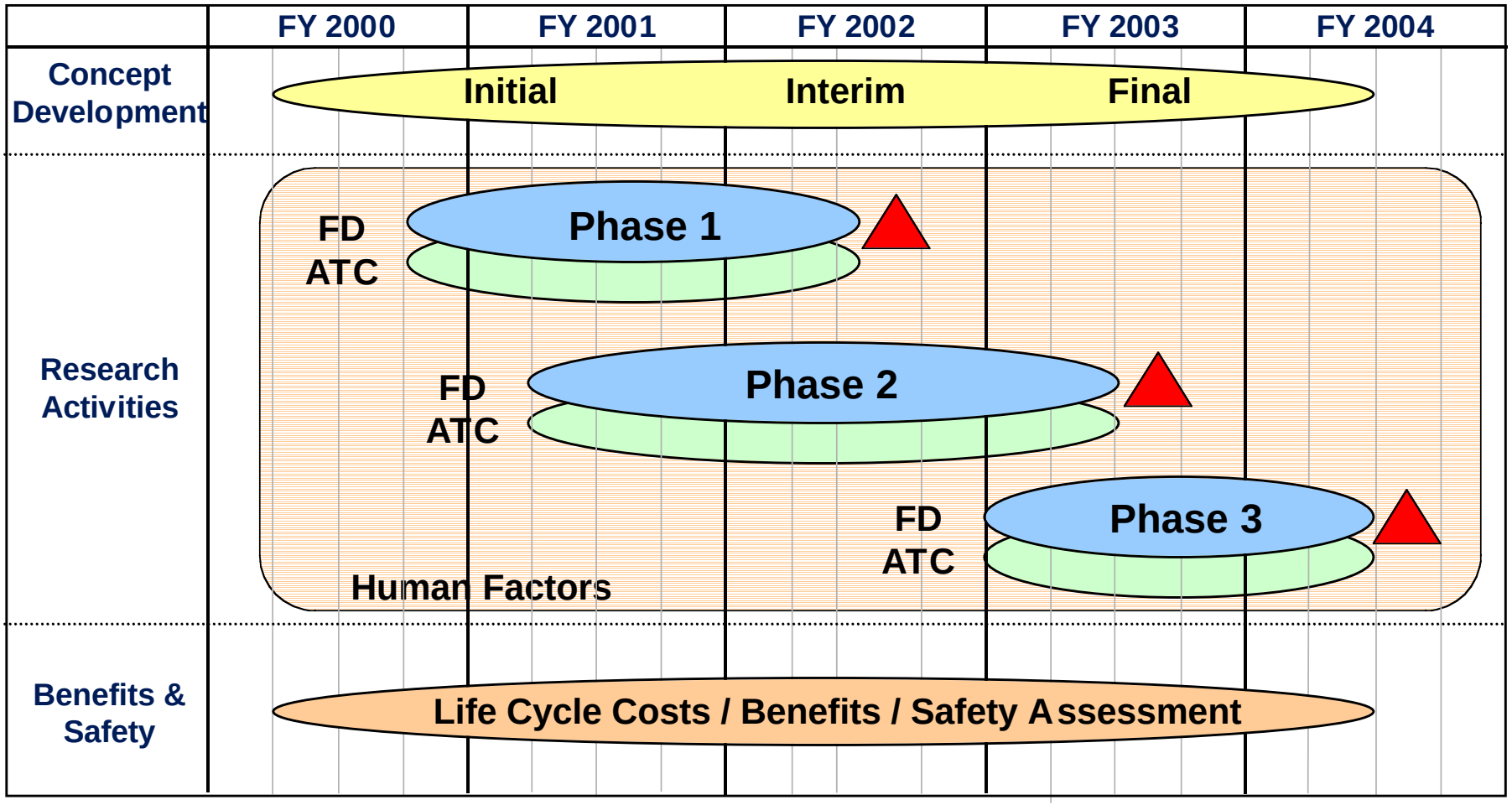
Automation Tools: Controller

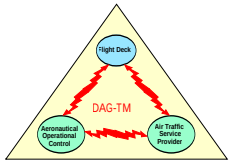


Activity Roadmap



Activity Roadmap





Presentations in this Session

- **Medium-Fidelity Flight Simulator Experiment Results**
  - **Amy Pritchett - Georgia Tech**
- **Cockpit Display of Traffic Information (CDTI)**
  - **Oscar Olmos - MITRE**
- **Approach Station Keeping Study**
  - **Parimal Kopardekar - SRC/FAA**